CLASSIFICATION OF PHYSIOTHERAPY APPARATUS AND SUGGESTIONS FOR A STANDARD EQUIPMENT *

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The purpose of this paper is to present a classification of physiotherapy apparatus that will serve as a guide in equipping such departments. Later, I will suggest equipments for the three situations in which these methods are most used: The office of an orthopedic surgeon having only private practice; the office of a surgeon having industrial, as well as private practice; and a hospital. The paper will be confined to a discussion of machines of proved efficiency—when operated by trained technicians—and will present only the physiological results obtained, omitting the equally important and fascinating psychological effects on the patient of the technician, the machine and the atmosphere in general of the treatment room.

Hitherto physiotherapeutic apparatus has been classified according to its mechanical construction. That is, it has been labeled hydrotherapeutic apparatus if it used water to obtain results, electrotherapeutic apparatus if it used electricity, heliotherapeutic if heat or light were the medium, and mechanotherapeutic if weights or friction. And appended to the description is usually a list of the phenomenal results it achieves. But I wish to turn that classification around: name the effects that physiotherapy treatments strive to obtain, and list the apparatus accordingly as it helps toward one effect or another.

The purpose of physiotherapy is the same, of course, as that of medicine in general, namely, to aid in the restoration of normal function. But because these means of aiding the restoration are limited, the patients that can be helped are limited and fall, for the most part, into a few general classes. I venture to list them as follows:

1. Traumatic injuries to bones and soft parts. In this group fall fractures, dislocations, sprains, strains (including that mongrel "strain of the sacroiliac region"), synovitis, brusitis, contusions and lesions of nerves, myositis, contusion of muscle tissue, tendo-synovitis, some infections, particularly of hands or feet, and similar conditions.

2. Injuries to the central nervous system; in which group fall hemiplegia, infantile paralysis, and locomotor ataxia.

3. Selected cases of certain congenital conditions, as the various foot and back deformities.

4. Selected cases of patients convalescing from operations or functional diseases, especially neurasthenia.

In all these cases that fall to the physiotherapist under the supervision or instruction of physicians, there are certain specific physiological results to be obtained:

1. There is needed a stimulation of local circulation. This helps to hasten growth of bone, replacement of bruised by normal tissue, reabsorption of blood and lymph and other products of inflammation, and similar conditions such as found in fractures, sprains, contusions, arthritic joints, flat feet, dislocations, synovitis. The machines found useful for this are:

Electric bakers. These consist of semicircles of carbon filiment lights, backed by tin reflectors, all set in frames of various designs. They are made in several sizes from small ones that fit an arm to large ones that will span a back. The gas bakers consist of a row of gas jets, over which is slung a hammock to hold the arm or leg, and the whole covered by a rounded tin or zinc cover.

Local massage supplements the baking and need not be described.

Thermolites consist of single high powered incandescent globes backed by reflectors that focus the rays to a point about one foot from the light.

Diathermy current from the high frequency machines. This is a current of very high voltage and such rapid alternation of polarity (over 500,000 a second) that it passes through the tissues without causing any contraction of either striped or unstriped muscle fibres. It is applied through two electrodes, one on either side of the part to be treated. The current passing directly between these two electrodes, creates, by friction, a local hyperemia—greatest in the denser tissues, as bone.

Whirlpool baths, which consist of cylindrical water-tight containers, made to fit a leg or an arm. In the sides are several inlets for the hot water that continuously pours in, swirls around the tub and flows out through a vent in the bottom.

Hot compresses.

2. There is the need of loosening cicatricial tissue and stretching or breaking such adhesions as do not necessitate an anaesthetic. Such cases are exemplified by the minute adhesions of old arthritis along the spine or other joints, septic hands, burns, skin grafts, scars from deep lacerations, chronic sciatica, and other neurites cases of long standing. The methods successfully used, besides local "friction" or massage, are:

Mechanical vibrators.

Sayre's head sling, which is especially helpful in breaking the minute adhesions between the vertebrae in cases of long standing arthritis. It is a halter, fitting comfortably under the chin and the occiput, attached to a hook in the ceiling or wall; strapped in this, seated or lying, the patient can be partially or completely suspended by means of a rope and pulleys.

Electricity from the negative Pole of a galvanic current, i. e., a direct current. This is used in loosening tough, adhesive scars. A small "active" electrode attached to the negative pole and saturated with a 10 per cent solution of sodium chloride is shaped to fit and bound upon the cicatrix; a larger "indifferent" electrode attached to the positive pole is placed at the patient's back, or under his hand. It is claimed that the effect on the tissues immediately under the active electrode are: vaso-dilatation, increased sensitiveness, liquefaction and disintegration of tissues due to the action of the current as an alkaline caustic.

3. There is the need to aid general metabolism, which may be accomplished by stimulation of the general circulation. This is often prescribed for neurasthenic patients, or those convalescing slowly from operations or long illnesses.

General massage may be helpfully supplemented by body bakers which are electric light cabinets that envelop the entire body, and are so arranged that the patient may either sit or lie.

Showers, which include douche, needle, and overhead showers, and demand a large room with con-

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trol table, drains, and hot and cold water reservoirs, are useful parts of more elaborate equipment.

4. There is the need of increasing the strength and improving the co-ordination of local groups of muscles or of the general body muscles. Such treatment is indispensable in cases necessitating splints, casts, or slings; in paralyses, either peripheral or central; in posture training; chronic brusitis; back strains; or foot conditions. Sometimes, even, it is necessary to teach entirely new co-ordination by education. Particularly is this so after a tendon transplantation, or in a case where one limited movement must be compensated for by other movements. An example of this would be training shoulder rotation to take the place of limited supination and promotion of the forearm. The equipment most helpful in these cases are:

Gymnastic apparatus, as bar stalls, rings, wall parallels (short parallel attached to the wall), pulley weights with handles overhead, shoulder high, and from the floor; special pulley machines for the fingers, wrists, ankles, and head; forearm pronators and supinators, and wrist rollers.

Bristow coils, which is a small easily handled box, equipped for faradic (or induced) current, which is slowly increased and decreased by inserting and drawing out a wire core. When the small, active electrode is applied to a nerve point and the core worked in and out, the muscle contracts in answer to the stimulated nerve. Lack of reaction to this current is the first electrical sign of "Reaction of Degeneration."

Sinusoidal current, which is a direct current made alternating by a mechanical device. The current slowly increases and decreases on the positive side, and then on the negative side—represented in graphic form by the well known sine wave—causing contraction by direct stimulation of the muscle fibres.

Interrupted galvanic and faradic currents, which cause spasmodic contraction of the stimulated muscle at the moments the current is made and broken. Interrupted galvanic is used as a test for the "Reaction of Degeneration."

Floor boards for foot and balancing exercises. The three types most in use are: (a) A straight wooden car rail for balancing exercises; (b) ladders laid on the floor for precision in foot placement (as in treating locomotor ataxia); (c) three boards about six inches wide are taken. Two of them are braced against each other, making a ridge that inverts the feet when the patient walks along with one on either board; the third board is placed parallel about sixteen inches away, tilted so that it everts the foot.

5. And lastly is the need for a stimulating or sedative effect on nerve fibres in cases of occupational neuroses and neuritis. Successful results have been obtained in these cases by the application of certain electrical currents. Whether the physiological effect is hyperemic, as some experimenters claim, or whether it is chemical and electrical, as others claim, has not been proved. But the results remain and are obtained by the use of:

Ouidon high frequency or so-called "violet ray" current.

Galvanic current from the negative or positive poles. The effects obtained by application of current from the positive pole are the reverse of those obtained from the negative pole. While the negative pole increases bleeding, produces hypersensitiveness, liquefies and disintegrates tissue, is a vaso-dilator, and has an alkaline reaction; the positive pole stops bleeding, is sedative, hardens tissue, is a vaso-constrictor, and has an acid reaction.

So to choose equipment for special type of work should be merely a checking of (1) the physiological needs to be filled, (2) the space alloted, and (3) the cost of the machines. For instance, an orthopedic surgeon, having private practice, might find this a useful combination:

Operator (which we have already taken for granted). A massage table reaching just below the operator's hips, small table and stool for hands. Local baker, large enough to span a back; pulley weights, one, two or three handles; long mirror for posture training; wand or broom stick. Optional additions are: Bristow coil; stall bars (home made); galvanic and sinusoidal machine; small diathermy and "violet ray" machine; measuring instruments and Sayre's head sling.

A physician carrying industrial as well as general private practice, might install:

Operator, necessary number of large and small tables and stools; local baker; various pulley weights and finger machines; wand or broom stick; bar stalls; large high frequency machine; Bristow coil; galvanic-sinusoidal machine, and measuring instruments. Optional additions are: Mechanical vibrator; whirlpool baths; added gymnastic apparatus.

To the above, a hospital would surely add a hydrotherapy department with tubs, showers, a sitz bath, as well as a body baker. Any and all of the appliances may be operated by properly educated and trained physiotherapy technicians acting under the supervision and instructions of physicians.

Static machines, the cautery current of the high frequency machines, and the actinic ray machines have not been mentioned. The static machines are not found in the majority of physiotherapy departments, perhaps because of their size and noise, probably because they are not completely understood by most persons. The cautery and the actinic ray machines usually are, and should be, operated by the physician himself, and not by the technician. The actinic ray machines, especially, are becoming more and more understood and used both as the air cooled model for general treatments, and the water cooled for local or prolonged treatments. These machines consist essentially in lights devised to emit only the violet rays of the spectrum. The short rays that have strong germicidal effect are employed in infections such as tonsilitis, sinusitis, mastoiditis, vaginitis, and similar conditions, as well as in conditons such as skin eruptions, psoriasis, some acnes, and it constitutes part of the routine treatment for tuberculosis in many hospitals.

To sum up: Conditions falling into a physiotherapist's hands for treatment under supervision or instructions of physicians may be summarized as:

1. Traumatic injuries to bones and soft parts;
2. Injuries to the central nervous system;
3. Certain congenital conditions, and
4. Selected cases of patients convalescing from operations and functional illness.

The physiological results sought by the treatment are:

1. Stimulation of local circulation;
2. Stimulation of general circulation;
3. Loosening of cicatrices and adhesions;
4. Increase of muscle strength and improvement in co-ordination;
5. Sedative or stimulative treatment for nerves.